ORIGINAL

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

In the Matter of	)	
	)	
Amendment of Section 15.247(a)(1)(ii) of the Commission's Rules on Spread Spectrum Operation	)	**RM-8608**
	)	
	)	

TO: The Acting Secretary

REPLY OF SYMBOL TECHNOLOGIES, INC.

1. Pursuant to Section 1.405(b) of the Commission's Rules, Symbol Technologies, Inc. ("Symbol") submits this Reply to comments filed on Symbol's Petition for Rule Making ("Petition") in the above-captioned proceeding.

2. On December 6, 1994, Symbol filed a Petition in this proceeding which asked the Commission to amend Section 15.247(a)(1)(ii) to reduce the minimum number of hopping frequencies at 2400-2483.5 and 5725-5850 MHz from 75 to 15 and to increase the maximum permissible bandwidth. Symbol's Petition appeared on public notice on February 28, 1995.

3. Six comments were filed and served on Symbol.[1/] Of those, Apple, Norand, and SpectraLink support Symbol's proposal; AT&T and Aironet oppose it; and Tel-A-Tech takes no position.[2/]

A. A Majority of the Comments That Take Sides Support Symbol's Proposal.

4. Apple "fully supports these goals" of Symbol's Petition.[3/] SpectraLink "concurs with Symbol that the reduction of frequency-hopping channel assignments, coupled with a corresponding increase in the permissible occupied transmitter bandwidth, will allow a higher data transmission throughput and facilitate the development of advanced wireless data applications to meet consumer demand."[4/] Norand agrees with Symbol that "[r]educing the number of frequency hops will allow manufacturers to expand their market by making it easier to produce the same products for use in the U.S. and Europe."[5/] Norand also

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[1/] Letter from Aironet Wireless Communications, Inc. to FCC (April 10, 1995) ("Aironet"); Comments of Apple Computer, Inc. (filed April 7, 1995) (" Apple"); Opposition of AT&T Corp. (filed April 7, 1995) ("AT&T"); Comments of Norand Corp. (filed March 30, 1995) ("Norand"); Comments of SpectraLink Corp. (filed April 7, 1995) ("SpectraLink"); Comments of Tel-A-Tech Communications, Inc. (filed April 7, 1995) ("Tel-A-Tech"). Symbol has no objection to the acceptance of Aironet's late-filed submission.

[2/] Tel-A-Tech's sole request of the Commission is to issue a Notice of Proposed Rule Making before amending the rules. Tel-A-Tech at 2-4. This request is consistent with the requirements of the Administrative Procedure Act, 5 U.S.C. § 553(b), and Section 1.412 of the Commission's Rules.

[3/] Apple at 3.

[4/] SpectraLink at 1.

[5/] Norand at 3.

"supports Symbol's proposal to increase the permissible frequency bandwidth"[6/] and "concurs with Symbol's assessment that these proposed changes will not impact the interference potential for operations in this spectrum."[7/]

B. Symbol Supports Increasing the Proposed Minimum Number of Hops from 15 to 20.

5. Symbol's Petition proposed setting the minimum number of hops at 15.[8/] Among other grounds, Symbol noted that this change would provide potential compatibility with European standards, which use a minimum of 20 hops.[9/] Norand suggests that the Commission likewise set the minimum number at 20, in conformity with European standards.[10/] Symbol supports this suggestion.[11/]

6/ Id.

7/ Id.

8/ Petition at 7-8.

9/ Id. at 8. Aironet (at 3) challenges the relevance of this ground by stating that few 2.4 GHz frequency-hopping systems have been deployed in Europe to date. By the same token, however, very few such systems have been deployed to date in the United States. The technology is nonetheless poised for rapid take-off on both sides of the Atlantic.

10/ Norand at 3.

11/ This change requires a corresponding change in the limits on dwell times. Symbol had earlier proposed that the average time of occupancy on a single frequency not exceed 0.4 seconds within a 6 second period. Clarification of Symbol Technologies (filed April 7, 1995) ("Clarification"). The change in minimum number of hops from 15 to 20 requires the 6 second polling period to be increased to 8 seconds. Proposed language appears in the Conclusion.

C. Adoption of Symbol's Proposal, As Modified Herein, Will Not Significantly Increase Interference.

1. Symbol's proposal will not increase interference to wideband users.

6. Several comments claim that reducing the minimum number of hops will necessarily increase interference to wideband users.[12/] According to Apple, "[N]arrow-band implementations employing fewer hopping channels could dominate a frequency range and cause that range to appear occupied (and hence unavailable) to devices employing wideband channels."[13/]

7. This argument is mistaken Its flaw is the very low minimum bandwidth (25 kHz) for frequency-hopping systems in the Commission's Rules.[14/] To take an extreme example, a system operating under today's rules could use 75 hops at a bandwidth of 25 kHz. It would then "dominate" the narrow range of 2.9 MHz and cause that range to appear occupied to other devices. In other words, the evil alleged to flow from Symbol's proposal is already built into the rules, and to Symbol's knowledge has not caused any problems in practice.

8. Symbol also disagrees with AT&T's contention that the technical discussion in Appendix A to Symbol's Petition,

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[12/] Aironet at 2; Apple at 3; AT&T at 4. AT&T also challenges Symbol's Technical Discussion at Appendix A of the Petition, especially as it concerns additional interference to wideband systems. AT&T at 4-5. Symbol responds in paragraph 8, below.

[13/] Apple at 3. AT&T (at 4) makes a similar claim.

[14/] 47 C.F.R. § 15.247(a)(1).

concerning interference to wideband systems, is erroneous. AT&T states:

> [1] The interference received by the wideband receiver is determined by the ratio between the bandwidth of the wideband system and the total bandwidth used by the frequency hopping system. [2] That ratio is independent of the hopping rate. [3] Thus, the wider the frequency hopping system's bandwidth, specifically 5 MHz as proposed versus 1 MHz as now permitted, the more it will interfere with wideband systems.[15/]

Sentence [1] is correct and consistent with Symbol's Appendix A. Sentence [2] is correct but irrelevant. Sentence [3], however, does not follow from the first two. AT&T is apparently concerned that a 20-hop system at 1 MHz, for example, will occupy only 20 MHz, compared with a 75-hop system at 1 MHz that occupies 75 MHz, which would worsen the ratio between the bandwidths of the wideband and frequency-hopping systems. As noted in paragraph 7, however, the minimum bandwidth specified in the Rules is only 25 kHz, so a system operating under the current rules can occupy as little as 2.9 MHz. While Symbol's proposal reduces the minimum occupied bandwidth to 0.5 MHz, both of these numbers are so small, relative to the spectrum occupied by typical wideband systems, that the change would be of no practical consequence. In practice, moreover, this worst-case scenario is unlikely ever to arise, inasmuch as Symbol's proposal

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15/ AT&T at 4-5 (sentence numbers added).

is intended specifically to promote frequency-hopping systems that use higher bandwidths than are presently allowed.[16/]

2. Symbol supports reducing the limit on output power to reduce interference to narrowband systems.

9. Symbol has conceded that its proposal may increase the potential for interference to narrowband systems, although the numbers remain very low.[17/] To mitigate this concern, Symbol supports Norand's proposal that, for bandwidths over 1 MHz, maximum output power be decreased by the ratio of the bandwidth to 1 MHz.[18/] For ease of application, Symbol prefers this equivalent formulation:

max. power = 1 watt * (no. of hops) / 75

Thus, a 2 MHz system (38 hops) would be limited to 0.5 watt, a 4 MHz system (19 hops) to 0.25 watt, and so forth.

C. Other Matters

1. Symbol Has Clarified Its Proposal To Ensure That Maximum Dwell Time Does Not Exceed 0.4 Seconds

10. Several comments correctly point out that Symbol's original proposal can be read to permit dwell times on a single

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[16/] It is also worth noting that the processing gain achieved at 20 hops exceeds 10 dB, which is the minimum processing gain required of direct sequence systems. 47 C.F.R. § 15.247(e). A 20-hop minimum thus satisfies the Commission's overall standards on sharing generally among spread spectrum systems.

[17/] See Appendix A to Symbol's Petition for Rule Making.

[18/] Norand at 3.

frequency of up to 2 seconds.[19] It was not Symbol's intention to increase the dwell time beyond the present maximum of 0.4 seconds. Accordingly, on April 7, 1995, Symbol filed a Clarification with a conforming change to the proposed wording of the rule.[20]

2. The Commission's decision not to allocate 2402-2417 MHz for licensed services does not moot Symbol's Petition.

11. Symbol rested its Petition in part on the then-prospect of the Commission's allocating part of the 2.4 GHz band for licensed services.[21] Two comments note that the Commission subsequently voted against the allocation and argue, "[T]here is no restriction on the availability of frequency spectrum that would justify [Symbol's] proposed amendment."[22] But the developments in that docket do nothing to undercut the other grounds stated in the Petition: increased exports of equipment for use in Europe and higher speeds and lower costs in the emerging market for wireless computer networks, with no

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[19] Aironet at 2; Apple at 4 n.8; AT&T at 3-4; SpectraLink at 3-4).

[20] That conforming change must be further modified to accommodate the change in minimum number of hops from 15 to 20. See note 11.

[21] Petition at 6-7; Allocation of Spectrum Below 5 GHz, 9 FCC Rcd 6779 (1994) (Notice of Proposed Rule Making).

[22] Aironet at 3. See also AT&T at 3 (similar). The Commission decided against the allocation in Allocation of Spectrum Below 5 GHz, ET Docket No. 94-32, First Report and Order and Second Notice of Proposed Rule Making, FCC 95-47 (released Feb. 17, 1995).

significant increase in the threat of interference to other users of the band.[23] In short, Symbol's Petition continues to be well supported.

3. Symbol's proposal will not hinder the work of IEEE 802.11.

12. One comment states, without explanation, that "adoption of Symbol's proposal at this time could adversely affect the efforts of the IEEE 802.11 Committee to develop an industry-wide standard for wireless LANs using spread spectrum in the 2400-2483.5 MHz band."[24] This statement is incorrect. The current draft of the 802.11 specification provides for several options including infrared, direct sequence, and frequency hopping. In the future, the 802.11 Committee might well take advantage of a change in the rules to add another option; but Symbol's proposed amendment would not require any changes to the current 802.11 options.[25]

CONCLUSION

13. For reasons given in its Petition, Symbol asks the Commission to amend Section 15.247(a)(1)(ii) as follows. Added material appears in **boldface**. Changes proposed for the first

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[23] Petition at 8-9.

[24] Apple at 3.

[25] Apple also states that "additional consideration should be given to the needs of non-LAN devices, to ensure that any rule changes meet the overall requirements of all users of the band." Apple at 4. This statement in its present form is not specific enough to permit a reply.

time in this Reply are indicated by ~~strikeout~~ and double underline.[26/]

> (ii) **(A)** Frequency hopping systems operating in the 2400-2483.5 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.
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> **(B) As an alternative to paragraph (A), frequency hopping systems operating in the 2400-2483.5 MHz and 5725-5850 MHz bands may use at least ~~15~~ 20 hopping frequencies whose 20 dB bandwidths do not overlap. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within ~~a 6~~ an 8 second period.**

[26/] Symbol noted in its Petition that paragraph (A) below is no longer strictly necessary, because equipment operating under paragraph (B) will also comply with paragraph (A). Symbol nonetheless urges the Commission to leave paragraph (A) intact to reassure readers who lack technical training that products manufactured in accordance with the present rule will satisfy the proposed rule as well.

The maximum power of a system operating at fewer than 75 hops is that specified in subsection (b) multiplied by the ratio of the number of hops to 75.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, Mitchell Lazarus, do hereby certify that on this 24th day of April, 1995, I have caused copies of the foregoing "Reply of Symbol Technologies, Inc." to be served by hand upon the following:

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